Geoarchaeology – A New Discipline?

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Geoarchaeology is an emerging scientific field at the interface between archaeological and earth sciences, with a growing and vital community in Germany. Since *Butzer* (1973) first introduced the term geoarchaeology, several books on this topic have been published in the past three decades: for instance, *Gladfelter* (1981, 1985), *Butzer* (1982), *Brown* (1997), *Goldberg* and *Macphail* (2006) and *Rapp* and *Hill* (2006) (bibliography after *Butzer* 2008). For the past 10 years, scientific interest in geoarchaeological research has been increasing. Milestones of this development are the funding of geoarchaeological working groups in Germany, the United Kingdom and other countries, the establishment of study programmes (e.g. the M.Sc. Geoarchaeology at the University of Reading and the M.Sc. Geoarchäologie at the University of Marburg) and graduate programms (Graduate Group Landscapes of the Excellence Cluster Topoi, Berlin, and the Doctoral Graduate School Human Development in Landscapes in Kiel). Furthermore, a glance at the calendar of international conferences reflects the growing interest of an international community:

2009: Geoarchaeological Meeting in Sheffield (United Kingdom)
2010: 1st International Landscape Archaeological Conference (LAC2010) in Amsterdam (The Netherlands)
2010: Egypt and the Mediterranean World in Cairo (Egypt)
2011: AGU Chapman Conference on Climates, Past Landscapes and Civilizations, in Santa Fe (USA)

Beyond that, sessions with a geoarchaeological background have become an integral part of the meetings of the major geosciences organisations such as the International Union for Quaternary Research (INQUA) and the European Geoscience Union (EGU).

In their fundamental work, *Rapp* and *Hill* (1998) point out that geoarchaeology is a conceptual approach and implies the application of concepts, methods and knowledge from earth sciences to answer archaeological problems. Since the 1970s interdisciplinary exchange between archaeological science and several disciplines of earth sciences has grown (*Butzer* 2008). Today, besides geoarchaeology, two other research fields deal with the interface between archaeology and earth/social science: archaeometry and landscape archaeology.

Fuchs and *Zöller* (2006) in their review clearly express the differences between geoarchaeology and archaeometry as established in the Anglo-Saxon scientific community. In contrast to geoarchaeology, archaeometry embraces the different technical approaches originating from natural sciences – with a large contribution from earth sciences – such as chemical, mineralogical or biological laboratory techniques as well as field survey practices at different scales, ranging from remote sensing methods to drilling techniques. The compendia "Einführung in die Archäometrie" (*Wagner* 2007) and "Archäometrie: Methoden und Anwendungsbeispiele naturwissenschaftlicher Verfahren in der Archäologie" (*Hauptmann* and *Pingel* 2008) give an overview of the multiple approaches available in this field.

The roots of landscape archaeology stretch back to the 1960s, when environmental archaeologists started to use concepts from the earth sciences and cultural ecology. Landscape was understood as a factor determining human behaviour. Today the definition of landscape strongly depends on the disciplinary background of the researcher. Topics in modern landscape archaeological research include concepts from social anthropology, social theory and philosophy as well as the question how ancient cultures perceived and ordered their environment (*Kluiving* et al. 2011).

While *Rapp* and *Hill* (1998) associate geoarchaeology with the archaeological sciences, contradicting we would like to highlight that geoarchaeology is deeply rooted in geographical and geomorphological research. Geography is the discipline that focuses on human-environment interactions on various scales and from various approaches. It analyses natural and societal site characteristics, the relation between different types of settlement characteristics and human adaption strategies, and the resulting feedback reactions (*Schütt* and *Meyer* 2011). In terms of human geography, these analyses primarily address the present-day situation and the (recent) historical past. By contrast, geomorphology as a physical-geographical discipline studies surface-shaping processes and their natural and/or human triggers under a long-term perspective and is thus closely linked to geoarchaeology (*Ahnert* 1996). Geomorphologists hypothesise that the analysis of present-day processes is a key to the understanding of processes and conditions that occurred in the past. Only rarely can processes be directly observed; in most cases, they are reconstructed by analysing the shape and material of landforms (*Chorley* 1962, *Chorley* and *Kennedy* 1971, *Slaymaker* 1997). The analysis of surface-shaping processes belongs to the core competences of geomorphologists; knowledge about ancient land use strategies, societal structures and management strategies of natural resources falls in the competence of archaeologists. Consequently, geoarchaeology is the result of an interdisciplinary or transdisciplinary approach involving geomorphological and archaeological knowledge, which is mandatory for a holistic perspective on the subjects under investigation.

This issue of DIE ERDE touches on various aspects of geomorphological research directly linked to archaeological sites and strongly focuses on landscape characters determining settlement patterns, land-use strategies, the management of natural resources or human infrastructure such as harbours.

Klinger et al. use multivariate data analysis to describe and classify the surroundings of

Karakorum and Karabalgasun, located in the middle and upper Orkhon Valley in Central Mongolia. The aim of the study is to analyse whether the siting of an archaeological site was determined by topography or by other factors. The authors compare site characteristics of burial sites, ritual places and settlements. Their results show that walled enclosures and settlements were predominantly built in the flat steppe region, whereas burial and ritual places were preferentially constructed in a mountainous and hilly environment.

The study by *Kelterbaum* et al. reconstructs the palaeogeographic evolution of the present-day Taman Peninsula in Russia, forming the eastern part of the Kerchens'ka gulf, connecting the Sea of Azov and the Black Sea. Historical sources and sedimentological as well as geomorphological results give evidence that the coastline of the area changed completely between the 6th and the 2nd century BC. For the settlement Golubitskaya 2, these environmental changes meant that it lost access to the sea. This might be one reason why the city was abandoned. Furthermore, the authors present a locally valid sea level curve for the area, based on analysis of sediment cores and radiocarbon dates.

The paper by *Vött* et al. also focuses on a coastal environment and investigates Pheia, the destroyed harbour of the city of Olympia (Elis, western Peloponnese, Greece), analysing sedimentary and geomorphological tsunami traces. From radiocarbon ages and archaeological age estimations of ceramic fragments, three tsunami events were dated to the 6th millennium BC, the mid-5th millennium BC, and the Byzantine to post-Byzantine period. Having resisted at least two tsunami events, Pheia was finally destroyed, most probably by a tsunami landfall in the 6th century AD.

Berking et al. present a methodological paper integrating techniques from terrain modelling, geophysics and environmental analytics to reconstruct the landscape in the hinterland of the ancient Meroitic city of Naga (Sudan). The following methods were applied: surveying the topography using a differential GPS, electrical resistivity measurements, ground penetrating radar, sedimentological approaches and dating techniques (OSL and radiocarbon dating). Their work focuses on the Great Hafir of Naga, an artificial basin to store runoff, and shows that the originally large basin is now silted up. During the heyday of Naga, the hafir had a maximum depth of 15 m and a storage volume of 37,000 m^3.

In their paper, *Bebermeier* et al. analyse the past and present landscapes in the surroundings of the Necropolis of Dahshur (Egypt). On the basis of geomorphological mapping, geomorphometrical analysis and sedimentological records, the authors try to distinguish between natural and artificial landscape areas. The results point to different geomorphological processes shaping the relief of the necropolis. From the late Old Kingdom onwards, aeolian dynamics led to the accumulation of a sand cover in the channel beds and have thus had a levelling effect on the topography. But human activities such as mining also affected the relief. Several depressions in the vicinity of the Bent Pyramid provide evidence of this activity.

The variety of research questions and applied methods of the papers presented in this special issue shows once more that geoarchaeology involves more than the reconstruction of palaeoenvironments and palaeoclimates deriving proxy data from soils, sediments and geomorphological evidence. The discipline benefits from the application of a large variety of methods to survey and analyse natural resources (such as water, ores, clay, building materials), subsurface explorations to locate sites, modelling approaches, as well as the application of geochronology and sedimentological, geochemical and mineralogical methods.

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